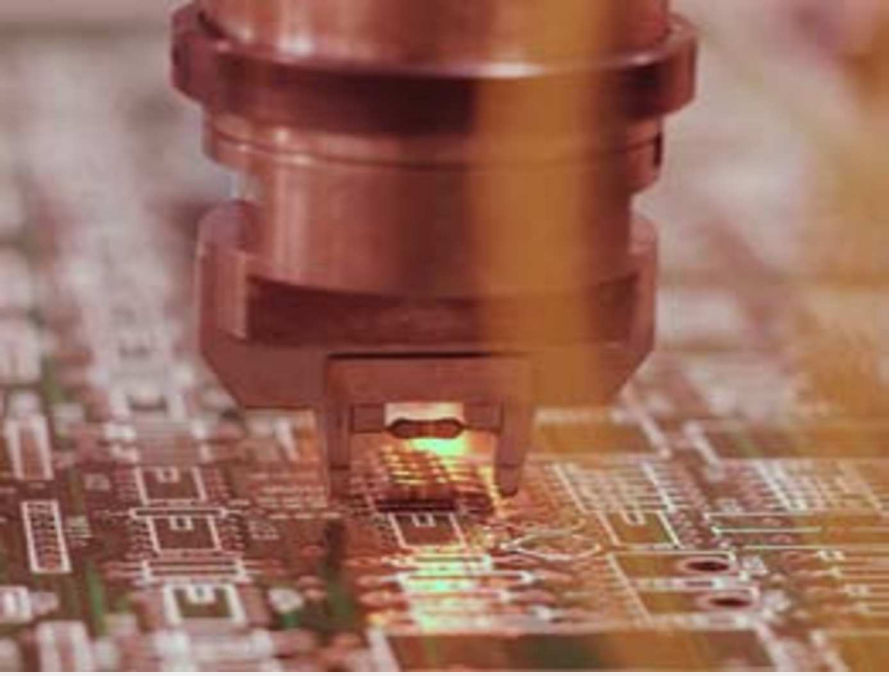


National Aeronautics and Space Administration

Robotics, Automation and Control

Digital Machine Control Electronics

Position sensors, switches, controllers, and communications electronics for robotic assembly

NASA's Marshall Space Flight Center offers a suite of novel technologies for digital control of electronic machinery. Originally developed for the autonomous assembly of modular space structures, the base innovations in the suite can improve gap sensors and absolute position sensors. They sense position and proximity and can also wirelessly communicate information to drive switching and stepper motor operations. The technologies can benefit a broad range of industrial robotics applications, and they can be combined to perform a variety of functions. Additional components in the suite can be incorporated into the base technologies to perform other sensor functions and serve as short-range antennas and close-proximity transmitters and receivers. The NASA innovations are self-calibrating and have embedded integrity-monitoring functions for assured position and proximity readings.

BENEFITS

- Low-Cost: the devices use simple, inexpensive components
- Exact: enables absolute position and improved precision compared to conventional position sensing techniques
- Accurate: provides precise control for multi-phase stepper motors
- Efficient: the same hardware can be used for measuring and communicating
- Small: footprint allows operation in small spaces, perhaps miniature applications

APPLICATIONS

- Internet of Things (IoT)
- CNC, water jet, and laser milling machines
- Hard disc drives, printers, and scanners
- Pick and place machines for semiconductor manufacturing and automated biotech operations
- Profilometers
- Industrial robots in which raster, head, and substrate are in close proximity
- Rotary and linear positioning of automotive engine components
- Robot-assisted surgery

technology solution

THE TECHNOLOGY

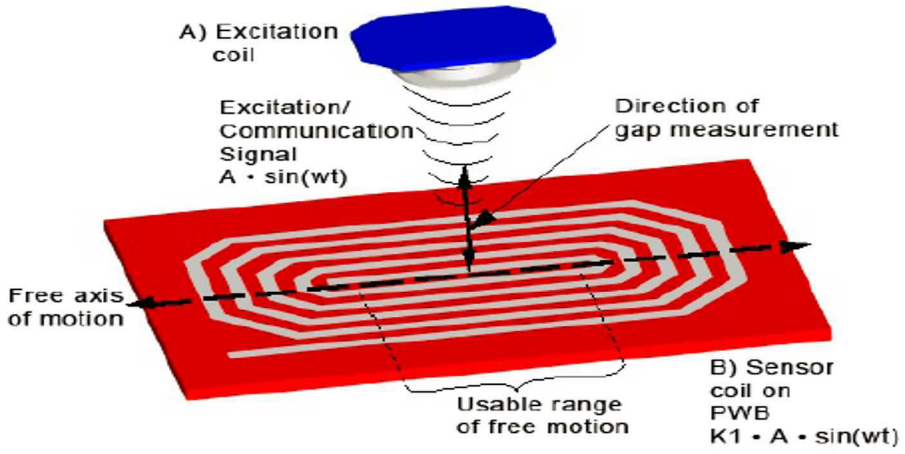
The SCAPS (Single-Coil Absolute Position Sensor) GAPSYN (Inductive Gap Sensor) Digital Signal Conditioning Electronics technology (MFS-32318-1) provides voltage that is proportional to the position of the sensor. This circuit processes two signals from the position sensor to determine the amplitude of an amplitude-modulated signal from the position sensor, correcting for gap fluctuations and nonlinearities.

An Absolute Limit Switch (MFS-32192-1) utilizes the SCAPS technology to produce an absolute limit switch point, such as to stop a movable carriage.

The system for sensing the position of a rotor in a hybrid stepper motor (MFS-32402-1) is a rate-insensitive (i.e., operates at any speed, including zero rate), linear feedback sensor system that can be used for controlling two-phase and multi-phase stepper motors.

The Micro-Commanding Servo Motor Controller With Greater Than Fifty Million To One Dynamic Rate Range technology (MFS-31529-1) senses rotary position of a drive shaft to derive appropriate drive signals for a motor.

The Short-Range Antenna/Close-Proximity Transmitter and Receiver technology (MFS-32228-1) is an inexpensive and effective method of exchanging information over a short distance between two devices when each is equipped with a SCAPS coil.



The transmitter & receiver technology improves inductive gap sensor technology by enabling it to both measure the gap and send data between two devices with the same sensor.

The position sensor can supply positional information on an incremental basis, and measure angular displacement in a hybrid stepper motor like the one shown, allowing closed loop control.

PUBLICATIONS

Patent No: 8,290,435; 7,081,730; 7,116,098; 8,098,060; 7,911,174

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

MFS-32228-1, MFS-31529-1, MFS-32192-1, MFS-32318-1, MFS-32402-1